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THE YELLOW TAIL OF JUVENILE COPPERHEADS*

By Wilfred T. Neill

Juvenile examples of a number of snakes, including crotalid and boid species, are remarkable in the possession of a tail that is bright sulfur yellow, at least distally. This peculiarity is very evident in the young of the American copperhead. Ditmars suggested that the yellow tail tip of this species might serve as a lure to frogs, basing this comment on the behavior of captive examples upon the introduction of food (The Reptiles of North America, 1936: 334). This interpretation seems to be generally accepted, but direct observations have seldom been reported. The following notes thus seem worthy of record.

On September 10, 1939, I collected an adult female copperhead *(Agkistrodon c. contortrix)* near Augusta, Richmond County, Georgia. The following day the snake gave birth to 11 young. The small snakes were put in a wooden box, the bottom of which was covered with scraps of dead leaves. Several cricket-frogs *(Acris crepitans)* were also introduced. The box was then left in a corner of the reptile house. About an hour later I peeked into the box, to behold a remarkable sight. In the shadowy interior of the container I could at first make out only a number of writhing, yellowish objects, for all the world like small worms or maggots. Closer inspection revealed that each little copperhead was coiled up and was holding aloft its bright yellow tail, which was writhing slowly, The blotched pattern of the snakes blended well with the leafy debris, and it was some time before I could resolve the outlines of all the little snakelets. As I bent over the box, the frogs spied me and began leaping wildly about, and immediately the snakes began wriggling their tails with increased vigor. When the frogs quieted down, the motion of the tails slowed and finally almost ceased. A slight motion on my part, however, was sufficient to start the frogs hopping again, and this was a stimulus to renewed activity on the part of the snakes. The frogs were apparently too disturbed to forage, and none fell prey to the copperheads. The demonstration indicated that the yellow tail tip could well function as a lure for frogs or other small creatures.

Augusta Junior College, Augusta, Georgia

* Read at the 24th Annual Meeting of the A.A.A.S., Southwestern Division, at Las Vegas, New Mexico, May 3-5, 1948.

NOTE: Mr. C. B. Perkins furnishes this reference: Malcolm A. Smith, in Fauna of British India, London, 1943, p. 500, states that the young of *Ancistrodon hypnale* wave their tails and that he saw small geckos actually grasp the tails whereupon they were struck and eaten.

BIRTH AND BEHAVIOR OF YOUNG COPPERHEADS*

By W. L. Chenoweth

A pregnant female *Agkistrodon m. mokasen* secured west of Wyandotte, Ottawa Co., Oklahoma, near Grand Lake on August 19, 1946, in a hollow log was 632 mm. long. In captivity the snake was very docile. At 6 P.M. on September 4, three small hatchlings were found crawling about in her pen and a fourth one was being born. The mother was lying in a half-moon position with her tail twisted to one side but not raised. The snake was extruded by a series of muscular contractions in the posterior part of the mother's abdomen.

Enclosed in its elliptical, membraneous, semi-transparent sac which was about 48 mm. by 35 mm., the fourth little snake did not move at all for about thirty-five minutes. Then it started to break out, struggling five minutes before it was free. Meanwhile the fifth and final one was being ejected. This took approximately ten minutes.

When the fifth had wriggled free from its sac, all five juveniles were very lively and struck often when annoyed, vibrating their tails rapidly. Their markings were similar to the mother's but the coloration differed slightly. The cross-bands and body color were darker than the corresponding areas of the adult. The tips of the tails were bright lettuce green. Their lengths were 219 mm., 222 mm., 224 mm., 200 mm., and 215 mm. They were removed to a different pen about an hour later.

When the young were observed at eight o'clock on the morning of September 10, two had shed and by noon the other three had followed suit. After this the tails had a yellowish hue. On this date they were offered very young mice but showed no interest in them. During the fall, mice were offered often but while the snakes sometimes struck them, they never ate them. One young copperhead was found dead on December 24. The other four were dormant during the winter months.

On April 8, 1947 a number of small cricket frogs *(Acris gryllus)* were placed in the pen and four were gone the next morning. From this time on they ate frogs at frequent intervals. The snakes' tails were now becoming a bright sulphur yellow. The second young snake died on April 23, and a third one on April 30. The other two were lively and ate frogs but on May 14 a fourth one died.

The fifth one continued to eat frogs at irregular intervals, but steadfastly refused baby mice. Like the others, it ate only at night. On May 26 it ate a chameleon *(Anolis carolinensis)*. After that it refused all food and died on June 26. It grew approximately 21 mm. in its nine months of life. At the time of its death its tail was a very dark yellow.

Wichita, Kansas

* Read at the 24th Annual Meeting of the A.A.A.S., Southwestern Division, at Las Vegas, New Mexico, May 3-5, 1948.

* * *

Results of the Questionnaire: The members who kindly filled in and returned the questionnaires expressed opposition to inclusion of book reviews, biographies, bibliographies, abstracts and local lists. As a consequence these will be restricted henceforth.

DR. ALBERT HAZEN WRIGHT

DR. ALBERT HAZEN WRIGHT, VICE PRESIDENT OF THE HERPETOLOGISTS LEAGUE

Dr. Albert Hazen Wright, our new Vice President, was born August 15, 1879 in Hamlen, New York. He entered Cornell University in 1900 where he was student and teacher for 47 consecutive years. He was retired emeritus July 1, 1947. Dr. and Mrs. Wright have traversed the U.S.A. to such an extent that they probably have no peers in having seen by far the greater proportion of species and subspecies of known reptiles and amphibians in the FIELD. Dr. Wright's name appears in *Whos Who and American Men of Science*. He is a member of twenty diverse societies.

UNUSUAL BEHAVIOR OF *STORERIA DEKAYI DEKAYI* IN GEORGIA*

By Wilfred T. Neill

In fifteen years of collecting in Georgia I have come upon ten specimens of *Storeria d. dekayi* perched some distance off the ground in vines or bushes; and in every instance the vegetation overhung a small stream. Such behavior could scarcely be a response to local conditions, for it has been noted in such dissimilar areas as the southern Appalachians, the lower Piedmont, and the Atlantic Coastal Plain; and at each locality the bulk of the population seemed entirely terrestrial. Arboreal tendencies would seem of little value to this primarily cryptozoic species, and might even be harmful in exposing the individual to predators that would otherwise overlook it. Possibly such actions represent a "vestigial" behavior pattern inherited from the *Natrix*-like snakes that are thought to have been ancestral to *Storeria*.

DeKay's snake is generally inoffensive in habits, but occasional large adults from Georgia will coil, flatten the entire body, and strike repeatedly at an approaching object. The pose and actions at such times are very reminiscent of an enraged *Natrix sipedon*.

In the Georgia Piedmont, *S. d. dekayi* may be found in almost any habitat. Below the Fall Line, however, it is mainly found in swampy woods in the vicinity of water, occurring frequently under fallen timber about lake margins and in piles of debris along stream beds. Its habitat in this area is thus similar to that of *S. victa* in Florida, as described by Carr (1940, Biol. Ser. Univ. Fla. 3, no. 1: 91).

Augusta Junior College, Augusta, Georgia

* Read at the 24th Annual Meeting of the A.A.A.S., Southwestern Division, at Las Vegas, New Mexico, May 3-5, 1948.

AN AMBYSTOMA EATS A SNAKE*

By Wm. E. Duellman

The following incident took place in the Dayton Public Library Museum in the latter part of July, 1947. The observer was Mr. Kenneth Dearolf, Director of the museum.

A small specimen of *Thamnophis s. sirtalis* (Linne) was placed in a cage containing a large adult *Ambystoma t. tigrinum* (Green). The salamander immediately took notice of the snake and then quickly seized it by the head. Although the snake writhed about in its attempt to escape, the salamander did not release its hold. For the rest of the day the swallowing process was continued. The next morning, nearly twenty-four hours later, Mr. Dearolf found the salamander in good condition with a portion of the snake's tail still protruding from its mouth. During the morning the salamander finished its meal and has shown no ill effects from it. The *Thamnophis* measured about 170 mm. in length. The *Ambystoma* measured 211 mm. in total length.

436 Greenmount Blvd., Dayton, Ohio

* Read at the 24th Annual Meeting of the A.A.A.S., Southwestern Division, at Las Vegas, New Mexico, May 3-5, 1948.

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RANA GRYLIO IN TEXAS

By Robert L. Livezey and H. M. Johnson

The occurrence of *Rana grylio* in Texas has been suspected for some time. However, to our knowledge there exist no substantiating published records.

On the night of April 30, 1948, a mill pond 200 yards west of U. S. Highway 96, three and three-quarter miles south of Silsbee, Hardin County, Texas, was visited. From this pond the pig-like grunting call of this form was heard. Investigation resulted in the capture of two males. Four others were seen, but escaped. No females, eggs or tadpoles were noticed. The following night, Dr. L. A. Ramsey of Texas Christian University visited the same pond and collected five additional specimens.

This pond, located in the southern margin of the Big Thicket region of East Texas, is typical of the habitat occupied by this species in Louisiana. There is a surrounding forest primarily of cypress, pine, oak and magnolia. The pond is about five acres in extent, not over two feet in depth, and with a thick growth of aquatic plants consisting of reed, water lily, sedge, waterweed and grasses. A thick, gummy, black mud covers the bottom.

Both specimens are relatively small, the measurements being: snout to vent 65.5 mm, 94.7 mm; head width 22.8 mm, 33.7 mm; head length 25.0 mm, 38.8 mm; thigh 25.4 mm, 38.8 mm; shank 28.7 mm, 40.4 mm; foot 46.7 mm, 71.0 mm. Coloration of both individuals is typical. Dorsum dark green with scattered, irregular rust spots. Throat creamy-yellow; venter and legs mottled with black on white background.

Other toads and frogs in and near the pond were *Bufo valliceps, Bufo w. fowleri, Hyla cinerea, Acris crepitans, Rana catesbeiana, Rana clamitans and Rana sphenocephala.*

Sam Houston State Teachers College, Huntsville, Texas

THE GREATER WESTERN SKINK IN NEVADA AND UTAH

By Ross Hardy

ROSS HARDY

A specimen of the Greater Western Skink, *Eumeces gilberti gilberti*, from the Sheep Mountains provides what seems to be the first from Nevada. Hobart Smith in his "Handbook of Lizards" gives the range of this skink as the Sierra Nevada Mountains of California, Northwestern Arizona, and a corner of Utah. No specimens from Utah or Nevada were referred to by him in the discussion nor do I know of any published records. On June 20, 1945, Albert V. S. Pulling and I took a male (now in my collection) from the west slope of the Sheep Mountains near Cow Camp Spring southwest of Hidden Forest, Clark County, Nevada. It was secured from beneath a large boulder where it had run for shelter. It had been seen abroad in the bright sunshine at about noon in the gravelly bottom of a small wash which runs through the pinon *(Pinus monophylla)* and juniper *(Juniperus utahensis)* in this area.

On June 14, 1945, the writer had observed a specimen near the summit of the Sheep Mountains not far from Cabin Springs in the northern part of this mountain range in Lincoln County. This individual escaped in the deep crevice at the base of a cliff rose *(Cowania stansburiana)*. The outcropping of rocks made it impossible to obtain the animal.

What may possibly be another individual of this species was observed on a north slope in the desert ash *(Fraxinus anomala)* and creosote bush *(Larrea tridentata)* area near Watercress Springs, one mile northwest of Saint George, Washington County, Utah. This skink, a rather large blue-tailed individual, was abroad in the sunshine during the day of March 23, 1946. It escaped beneath a huge boulder where it was unobtainable. This is about twenty miles from the nearest area where Skilton's skink *(Eumeces skiltonianus skiltonianus)* is known to occur. It could have been this latter species, but the large size of the individual observed suggests the possibility of *E. g. gilberti* occurring in this area.

The Clark County specimen has maximum snout-vent length of 91.8 mm.; tail, 93.9 mm.; fingers and toes slightly overlapping when adpressed; body brownish olive without stripes; head and neck above and below were tinged with orange-red (now faded); venter gray and yellowish-white; 26 scale rows around middle of body; 62 scales from parietal to the posterior margin of the thigh; supralabials 8.

Weber College, Ogden, Utah

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NEW MEXICO MEETING

The Herpetologists League met in association with nine other scientific organizations at the 24th Annual Meeting of the A.A.A.S., Southwestern Division, with the New Mexico Highlands University as host, at Las Vegas, New Mexico, May 3-5, 1948. We presented seven papers.

NEW MEMBERS

Mr. Le Vie P. Arnberger, Casa Grande Nat'l Monument, Coolidge, Ariz.
Mr. John Wendell Bailey, 27 Willway Rd., Richmond 21, Va.
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Mr. A. W. Mollison, Box 390, Billings, Mont.
Mr. J. R. C. Moseley, Jr., Box 1316 College Station, Tex.
Mr. Dee Jay Nelson, 729 Elm Dr., Billings, Mont.
Mr. Richard C. Pavey, 1200 W. Philadelphia Ave., Detroit 6, Mich.
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Mr. Royal D. Suttkus, Stimson Hall, Cornell U., Ithaca, N. Y.
PFC Kimball Wallis, HQ. Det., 25 Med. Bn,. APO 25, San Francisco, Cal.
Mr. Richard Wiezell, 7822 Oakleaf Ave., Elmwood Park 35, Ill.
Mr. Sterling Williamson, 1116 Drexel Ave., Drexel Hills, Pa.

* * *

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Mr. Allen R. Roberts, 18557 Pierson St., Detroit 19, Mich.
Dr. A. L. Schipper, Dept. Biol., U. of Notre Dame, Notre Dame, Ind.

NECTURUS AND *AMPHIUMA* IN TEXAS*

By Ottys Sanders

I. Necturus

The fact that the water-dog, *Necturus*, occurs in Texas came to my attention early in 1939, when I saw several specimens in rural-school collections from near Longview, Texas. One of these, from East Mountain, near Longview, Gregg County, was tentatively identified as *Necturus beyeri* Viosca (1,2), an identification subsequently confirmed by Mr. Viosca. The *Necturus beyeri* obtained *(No. 500, Coll. Ottys Sanders)* is a female, total length 165 mm., costal grooves 14, muzzle truncate in outline, somewhat turned up - "hog-nosed". Color in formalin: above, a light brown reticular mottling, broken by irregular pale spaces, with 40 or more rounded dark brown spots superimposed upon the whole dorsal area; below, much lighter in tone, with numerous smaller rounded brown spots on a pale pink-brown background. Spots on the sides tend to be rectangular, and give the general appearance of being arranged in cross-bands on the right side, and longitudinal bands on the left side.

Dr. Leo T. Murray, formerly of the Strecker Museum of Baylor University, Waco, Texas, states that that museum has a specimen of *Necturus* from east Texas in the same general area. This extends the range of *Necturus beyeri* westward from Louisiana into the Sabine River system of Texas, adding another salamander to the list of the State.

II. Amphiuma

Both the occurrence and range of *Amphiuma* in Texas has needed additional verification. Strecker & Williams (3) reported it from Bowie County, basing this on verbal reports of fishermen and others, without specimens to support the records. Strecker tried to investigate the Caddo Lake region, but could not at the time do so, because of heavy rains. Apparently the reports of Burt (4), Wright (5) and Bishop (6) are based on the above report of Strecker & Williams.

On April 1, 1934 I accompanied Dr. E. P. Cheatum of Southern Methodist University and his students to Carter's Lake near Jefferson, in Marion County, in the Caddo Lake region of Texas. While there, we collected a beautiful specimen later identified as *Amphiuma tridactylum* Cuv.

The present report concerns, however, a specimen still on hand. I took it May 1, 1938 in the Big Thicket area of Texas (at Jackson's Camp, 2 miles and 600 yards due north of Bragg, Hardin County, on the old Kountze-Livingston road.) It is a young *Amphiuma tridactylus* Cuv. *(No. 501, Coll. Ottys Sanders)*, measuring in total length 187 mm. Toes are 3-3, and there is a sharp demarcation of color between back and lower sides.

This extends the known range of Amphiuma about 175 miles southward in Texas, almost to the coastal area, and confirms both the presence and distribution thought probable by A. H. & A. A. Wright (5).

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(4) Burt, C. E. "Contributions to Texan herpetology, VII. The Salamanders." *Amer. Midl. Nat.*, Vol. XX, 1938, p. 375
(5) Wright, A. H. & A. A. "Amphibians of Texas." *Trans. Tex. Acad. Sci.*, Vol. XXI, 1938, p. 31
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The Southwestern Biol. Supply Co., Dallas 8, Tex.

* Read at the 24th Annual Meeting of the A.A.A.S., Southwestern Division, at Las Vegas, New Mexico, May 3-5, 1948.

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PRAIRIE RATTLESNAKE EATS SPADEFOOT TOAD*

By Robert M. Stabler

Our knowledge of the feeding habits of wild snakes is frequently incomplete. The general ecological importance of many species as consumers of small rodents, however, is well established. The prairie rattler *(Crotalus viridis)* is universally designated as feeding exclusively on small mammals and birds. The present note is the first record of the predation of this snake on poikilothermic quarry.

On August 20, 1947 the writer accidentally killed a prairie rattler some two miles northeast of Colorado Springs, Colorado. An examination showed that the stomach contained a partly digested, though easily recognizable, spadefoot toad *(Scaphiopus* sp.). This rattler is common in the area mentioned, and the unusual wetness of the summer kept these toads above ground later than normal. The spadefoot was readily available as food and in at least this instance, was eaten.

Colorado College, Colorado Springs, Colo.

* Read at the 24th Annual Meeting of the A.A.A.S., Southwestern Division, at Las Vegas, New Mexico, May 3-5, 1948.

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The Texas Herpetological Society held its annual meeting at Silsbee, May 1-2, 1948 with about 50 members present. Field trips into the Big Thicket were featured.

* * *

Mr. J. P. Lantz, 650 E. 163 St., N.Y. City 56, wishes to exchange living *Hyla crucifer* or other eastern amphibians for West Coast *Hylas*.

* * *

The Herpetologists League met jointly with the A.S.I.H. at the Western Division, A.A.A.S. meeting at the University of California, Berkeley, June 21-26. We presented three papers.

GRACE OLIVE WILEY

Mrs. Grace Olive Wiley was born Grace Olive Koontz, in Chanute, Kansas, in 1883. She marries Burt Wiley, of Caldwell, Kansas, in 1899. Later she attended the University of Kansas, where entomology was her chief interest. During the early years of her married life, she went to Texas with her husband and while there, collected insects for the University of Kansas. In this work she acquired her inspiration for the study of reptiles, which resulted in her life work in that field. The enthusiasm which she had shown in her early writings in entomology were carried on in her study of reptiles. Her name is perpetuated in the names of nearly a dozen insects. In 1923 Mrs. Wiley went to Minneapolis, Minnesota, as Curator of the Museum of Natural History, of the Minneapolis Public Library. While at the Museum she maintained a collection of live reptiles. She was able to keep snakes alive and healthy for longer periods than had been accomplished by any other collector. It was at the Museum, while talking to a visitor that one of the rattlesnakes crawled across her hand. This experience led to her desire to tame the snakes. She began by stroking them with a padded stick, and it was but a short time until she could pet them with her hand. It was surprising how readily they responded to her gentle treatment and soon showed no inclination to want to strike, and they became contented in their cages. Mrs. Wiley was the first person in the world to breed rattlesnakes in captivity. This unique feat was carried to the second generation.

Mrs. Wiley long ago established herself as an expert in the field of herpetological photography, with the first motion picture of a rattlesnake shedding its skin. This was followed by many years of work with life history and habits of snakes, all recorded by motion cameras.

Following her years of work at the Museum, Mrs. Wiley became Curator of Reptiles at the Brookfield Zoo, near Chicago. It was while there that Mrs. Wiley first tamed a King Cobra, on which her article "Taming King Cobra" is based.

After leaving the Brookfield Zoo, Mrs. Wiley made a lecture tour of the Eastern States, demonstrating her live animals as well as showing her famous motion pictures. While on this tour she wrote many articles concerning reptiles and their habits. She returned to Minneapolis for two years, where she continued to study and observe reptiles.

Mrs. Wiley, with her Mother, came to California in 1936, hoping to regain their health. Their car was loaded with reptiles, including her two-headed turtle which she had raised from a baby. Mrs. Wiley continued her work in Long Beach as a scientist, author and lecturer, with occasional work in motion pictures with her tame snakes. She continued

to add to her collection until she was forced to have larger quarters in the country where she displayed her reptiles at a small zoo.

After years of working with snakes, Mrs. Wiley had never been bitten by one of her *tame* animals, a record of which she was very proud, and justly so. On July 20, 1948, while posing a new, wild Indian Cobra, Mrs. Wiley was bitten on the finger, and in spite of prompt treatment, died an hour later.

Her enthusiasm and interest in reptiles has been an inspiration to hundreds of young herpetologists all over America, and has done much to overcome the prejudices which have generally existed for snakes.

Wesley H. Dickinson

* * *

LAMPROPELTIS TRIANGULUM GENTILIS IN MONTANA

By Dee Jay Nelson

The northern range limit of *Lampropeltis triangulum gentilis* (Baird and Girard) roughly follows a line from the north-eastern corner of South Dakota diagonally across the state to its southwestern corner, thence to south-western Wyoming and into Utah. Rawlins, Wyoming lies approximately on the northern limit of the range. The nearest accepted record of this snake to Montana is about 150 miles and to my home city of Billings, about 300 miles. On July 17th, 1947 I collected a specimen of the Western Milk Snake within 500 yards of the city limits of Billings.

My wife and I were horseback riding in the morning along a dirt road which ascends into a rocky area surmounted by a long rim of cliffs overlooking the city when I saw a small brightly colored snake. Before I could rein up, the horse stepped over the snake which made no attempt to escape but coiled its body tightly and tucked its head beneath the coils. The horse stood quietly while I dismounted and picked the snake up. The specimen, a male, was 23.5 inches long.

I kept the snake in a cage in my study where it persistently rubbed its nose against the screen until the rostral and prenasals were badly mutilated. It refused live mice repeatedly and seemed to fear them in the close confinement of its cage but eagerly accepted them dead.

Mr. A. W. Mollison of the U. S. Forestry Service, a herpetologist, confirmed my diagnosis of this snake and another presented to me by Mr. Lyons of the "See 'Em Alive Zoo", Red Lodge, Montana. The second, a young 9 inch example, was given to me August 29th, 1947. It was taken near Red Lodge by two local boys.

These are the only two snakes of this species I have encountered, so it is probable that the range of this snake should be extended to include southern Montana.

729 Elm Drive, Billings, Montana

* * *

NATURAL HISTORY CLUB OF NORTH BOHEMIA

The first issue of an annual journal of this club has just been received. It contains, among general natural history material, a list of the herpetofauna of Liberec. Secretary, Mr. Bedrich Benes, Liberec, 18 Samankova, CSR.

SUPPLEMENTARY OBSERVATIONS ON THE GEOGRAPHIC VARIATION OF *AMBYSTOMA MACRODACTYLUM*

By Joshua L. Baily Jr.

The well known tendency of widely distributed organisms to develop local races is of fundamental importance to any theory of evolution, for without something to select there could be no selection, either natural or otherwise. The evolutionary preservation of a specific trait may be the result of environmental pressure, either because it has survival value (1) or because it is positively correlated with a trait which has (2) or the preservation of one trait and the elimination of another may be quite fortuitous (3). It is obvious then that when a species begins to develop structural modifications which seem to be characteristic of local populations it is desirable that these be subjected to rigorous quantitative tests to determine if possible whether speciation is actually taking place.

The opportunity for such an investigation is afforded by an article in a recent issue of Herpetologica (4) by M.B. Mittleman entitled "Geographic Variation in *Ambystoma macrodactylum*". In this article the statement is made that individuals of this species from Idaho tend to have narrower heads than specimens of comparable length from farther west. This may well be the case, yet the present writer is inclined to question whether Mr. Mittelman's material is adequate to demonstrate convincingly that it must be.

Mr. Mittleman designates the head width by HW and the snout-vent length by SV. Since the present writer does not intend to discuss any other measurements he feels that it will simplify the discussion to fall back on the mathematical convention of designating the independent variable (in this case the snout-vent length) by x and the dependant variable (in this case the head width) by y, and the mean of a series of observations by M.

The mean values of the two variables, based on the data graphically displayed in Mr. Mittleman's Figure 1, together with some additional pertinent data hereinbelow discussed, are set out in the accompanying table:

	Oregon	Idaho	Difference
Mx	53.000 ± .796	52.837 ± .404	.163 ± .893
My	8.942 ± .094	8.595 ± .051	.347 ± .107
$My \div Mx$	.1687	.1627	.0060
$M\frac{y}{x}$	.1703 ± .0016	.1631 ± .0008	.0073 ± .0018
$Mx \div My$	5.927	6.147	.220
$M\frac{x}{y}$	5.920 ± .0551	6.148 ± .0315	.228 ± .0634
$\tan M(\tan^{-1}\frac{y}{x})$	.1703 ± .0016	.1631 ± .0008	.0073 ± .0018

From these figures it will be seen that the mean snout-vent lengths of the two samples are practically equal, but that the difference

between the head widths is somewhat greater, despite the fact that the head width is naturally numerically smaller. But this difference does not exceed its own probable error by a sufficient margin to justify the conclusion that the two populations from which these samples were drawn are significantly differentiated. However, Mr. Mittleman does claim that the two populations are differentiated with repsect to either of these variables, but only to the rates between them.

The simplest expression of the relation between x and y is the obvious one $My \div Mx$. It has the advantages of being easy to calculate, and still easier to visualize, as the point whose coördinates are Mx and My is the center of gravity of all points whose coördinates are the various pairs of associated values of x and y. But it has the obvious disadvantage of not being readily amenable to mathematical manipulation. There is no formula, so far as the present writer is aware, for the probable error of the quotient of two means, and without probable (or standard) errors it is not possible to determine whether a difference between two quotients implies that the two populations from which they are drawn are significantly differentiated or not.

But although there is no formula for the probable error of the quotient of two means there is one for that of the mean of a series of quotients (5). In this case the difference between $M(y/x)$ and My/Mx is not great, and in at least one recent treatise on zoological mathematics (6) the statement is made that it is never likely to be, but the authors of this work have been rather severely castigated by at least one reviewer (7) for having made such an assertion.

This use of the arithmetic mean of a series of ratios is subject to criticism on purely theoretical grounds. Its denominator is the common denominator of the series, and its numerator is the mean of the numerators of the series after it has been reduced to a common denominator (*i. e.* the terms of the ratios are given discriminatory treatment). Therefore its terms are the coördinates, not of the center of gravity of the observations, but of that of the projections of the observations from the origin onto a line parallel, in this case, to the axis of y. The result is that those observations whose ordinates have relatively high values are overweighted.

Further, since both terms of a ratio are expressed in the same unit, and since both are measurements made by a common technique, there seems to be no reason why the axis of x rather than that of y should not be chosen to determine the direction of the base of projections. Such procedure would make y the independent variable instead of x, and would overweight those observations whose abscissoe have relatively high values. Of course what is needed is a technique which would accord the same treatment to both terms of the ratio, and therefore equal weights to all the observations. A technique satisfying these conditions is to project observations, not onto a straight line, but onto a circular quadrant whose center coincides with the origin of coördinates. The desired ratio will then be that between the coördinates of the point whose distance from either axis measured along the arc of the quadrant is the arithmetic mean of the corresponding measurements for all the projections. Such a ratio would be the trigonometric tangent of the mean of the angles whose tangents are given by the original ratios, and since it involves a trigonometric function it may be designated the trigonometric mean. In mathematical symbols its value is given by the following formula;

$$M_t = \tan M(\tan^{-1} \frac{y}{x}).$$

In the computation of the arithmetic mean the labor can be greatly simplified by means of an ingenious device that is well known to all statisticians. But there is no comparable short cut in the case of the trigonometric mean, the computation of which is therefore somewhat laborious. It should be remembered that the trigonometric mean is available only where the fractions involved are ratios, *i. e.*, where both terms are expressed in the same units. Where the fractions are rates, *e. g.*, growth rates, the value of the trigonometric mean is affected by the unit in which the measurements are expressed, so that growth rates expressed in millimeters per day will give a very different trigonometric mean than might have been obtained from the identical observations expressed in inches per week. Further, the error of observation of the time interval is likely to be relatively so much less than that of the space interval that a technique according differential treatment may actually be preferable to one which does not.

We may now turn to the consideration of the data in the table. It will be noticed that the discrepancy between the mean of the ratios of the means is rather less when the head width (denoted by *y*) is taken to be the independent variable, and a superficial analysis might lead us to conclude the corresponding set of figures to be the more reliable. If such a conclusion be accepted we would not be justified in assuming the difference between these samples to be indicative of a real difference between the populations from which they were drawn, since the difference in the table does not exceed four times its probable error.

The trigonometrical mean, however, whose use seems logically defensible, turns out to be identical to four places of decimals with the mean of the ratios when the snout-vent length is taken to be the independent variable. The explanation of this agreement is that the ratios themselves are clustered fairly closely about their own mean. Had they been widely dispersed there would have been a different story to tell. As it is, confidence in the reliability of the trigonometric mean seems to be justified by this coincidence.

It will be noticed that the difference between the trigonometric mean of the two populations exceeds four times its probable error. Ordinarily no further investigation would be required; this fact would be accepted as conclusive evidence that the two populations were "differentiated" with respect to the ratio here under discussion, but unfortunately the number of individuals concerned in this investigation is not so large as we might wish it to be.

Fisher (8) has devised a procedure for testing the significance of differences between arithmetic means when the number of individuals concerned is not large. It is not directly applicable to trigonometric means, but since one of the factors of the trigonometric mean as hereinabove defined is an arithmetic mean Fisher's procedure may be applied indirectly. This factor whose formula is $\text{Mtan-1}\ \frac{y}{x}$ has for the Oregon population the value 9° 39′ 54″ and for the Idaho Population 9° 15′ 35″ with a difference of 24′ 19″ and the question arises, Is this difference to be considered of significance?

Fisher's method involves the use of a table connecting three functions, *n*, *t*, and *P*. The values of the first two of these are to be computed from the observed data and when they are known the valus of *P* may be read off from the table. In this case the values of *n* and *t* are such that *P* is considerably less than one per cent., which means that the chances that the observed difference can be accounted for by random sampling are negligible. Therefore we appear to be justified in

concluding the two populations to be differentiated in the way in which Mr. Mittleman suspected them to be.

A word of caution is needed here. We have proceded on the assumption that *Ambystoma macrodactylum* in Washington and Oregon constitutes a wide spread but closely knit homogeneous population. This may be the case, but it seems equally likely that in such a large area incipient local races might arise, not all of which would necessarily differ from the Idaho population in the same way. An investigation of this sort requires larger samples from more restricted areas.

In closing it is necessary to point out an unfortunate but obvious *lapsus calami* in Mr. Mittelman's paper which eluded his proof reader. The formula which he has used in computing the graph in the Figure 1 is capable of simplification; it can be reduced to

$$\frac{6 \log (SV)}{SV.}$$

The application of this expression to any specific snont-vent length gives the corresponding standard head with, so that the equation, of which the line in the figure is the graph must be

$$HW = \frac{6 \log (SV)}{SV}$$

But this is not the equation of a straight line such as appears in the figure, but of a curve asymtotic to the HW axis. Further, since a zero value of HW must be associated with a zero value of SV it follows that the desired graph should pass through the origin. But a curve asymtotic to either axis cannot do this, and it may be shown by extrapolation from the figure that neither will the straight line do so.

SUMMARY

1. An argument is presented favoring the use of the trigonometric mean over the arithmetic mean when the statistics dealt with are ratios whose terms are measurements made by the same technique and expressed in the same units.

2. Confirmation is given to Mr. Mittelman's conclusion that specimens of *Ambystoma macrodactylum* from Idaho are likely to have narrower heads than are specimens of comparable snont-vent length from Washington or Oregon, subject to limitations hereinabove noted.

3. Attention is called to an unfortunate *lapsus calami* by Mr. Mittelman.

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San Diego Society of Natural History

A NEW SUBSPECIES OF TREE-FROG FROM GEORGIA AND SOUTH CAROLINA

By Wilfred T. Neill

It was not until 1933 that *Hyla phaeocrypta* was recorded from the Atlantic Coastal Plain, and only recently have large series been available from this region. Extensive material in my collection reveals that the species is divisible into eastern and western populations, on the basis of both morphology and coloration. The type of *phaeocrypta* is a representative of the western subspecies; the eastern one is apparently unnamed. In allusion to its abundance in the Ogeechee River region and its frequent occurrence in Ogeechee-lime trees *(Nyssa ogeche)*, I propose to name the eastern subspecies

Hyla phaeocrypta ogechiensis subsp. nov.

TYPE. WTN No. 18007 (to be deposited in the collection of the Chicago Natural History Museum), adult male, collected June 15, 1948, by Wilfred T. Neill.

TYPE LOCALITY. Ogeechee River at Midville, Burke County, Georgia.

PARATYPES. Eight, same collecting data as type.

DIAGNOSIS. A tree-frog closely related to *Hyla p. phaeocrypta* but distinguished by the following characters: tympanum larger, ratio tympanum/eye averaging 52.5%, range 43.2-62.7% in sexually mature males; males larger, snout-vent length of sexually mature examples averaging 35.3 mm., range 32.0-38.5 mm.; females much larger and greatly exceeding the males in size, snout-vent length averaging 52.3 mm.; subocular light spot usually bright yellow, yellow-green, or grass green, frequently stippled with brown; posterior surface of humerus, axilla, side, groin, anterior and posterior surfaces of femur, inner and under surfaces of tibia, and outer surface of foot with a wash of very pale greenish-white or yellowish-white, variously mottled or vermiculated with dark brown or gray. In contrast, typical *phaeocrypta* displays the following characters: tympanum smaller, ratio tympanum/eye averaging 43.0%, range 33.0-47.5% in sexually mature males; males smaller, snout-vent length of sexually mature examples averaging 33.9 mm., range 29.0-40.0 mm,; females much smaller, scarcely exceeding the males in size, snout-vent length not exceeding 43 mm.; subocular light spot usually whitish or light yellow, infrequently stippled with brown; axilla, groin, and postfemoral surfaces bright green or yellow-green, variously mottled or reticulated with dark brown.

DESCRIPTION. A medium-sized tree frog superficially resembling *Hyla versicolor* but with a smoother integument. Head short and broad; snout short, bluntly rounded. Lore slightly concave; a blunt canthus rostralis. Nostril a minute perforation, set in a tiny, circular elevation. Eye large and prominent, pupil a horizontal ellipse. Tympanum small, with a raised peripheral ridge, its upper border somewhat obscured by a short, blunt ridge extending backward from the eye. Posterior nares prominent; vomerine teeth in two closely adjacent patches; orbits well separated; tongue subcircular, shallowly notched behind. Body moderately stout. Digits of fore limb 1-2-4-3 in order of increasing length, webbed at base; webbing extending as a tiny lateral flange to the well-developed terminal disk. Digits of hind limb 1-2-5-3-4; webbing moderately extensive, continuing as a narrow lateral flange to the terminal disk. A small metatarsal tubercle present.

Dorsum with numerous tiny warts or papillae (smooth to casual inspection); belly granular; posterior face of thigh just below anus with numerous enlarged white warts. Measurements of freshly killed specimen; snout-vent length 38.5, head length 11, head width 14.2, intertympanic width 11.5, horizontal diameter of eye 4.6, greatest diameter of tympanum 2.7, internasal space 3.5, interocular space 4.2, hind limb length 56.6, fourth toe length 16.7 mm.

Metachrosis pronounced. Coloration, when captured: Dorsum wood-brown; a brownish-black V-shaped marking between the eys; an irregular brownish-black marking, roughly X-shaped, on the anertior and middle portion of the back. A brownish-black band on the humerus, 2 on the fore-arm, 2 on the femur, 2 on the tibia, and 4 on the foot. Posterior surface of humerus, axilla, side, groin, anterior and posterior surfaces of femur, inner and under surfaces of tibia, and outer surfaces of foot (surfaces concealed when the animal is in a resting position) very pale greenish-white with brownish-black mottlings. Vocal sac with brownish suffusion anteriorly; edge of lower jaw white. Venter white. A vivid yellow subocular spot from eye to edge of jaw. A brownish-black band, sharp-edged above, extending from eye posteriorly above the insertion of the fore limb. A brownish-black stripe along the canthus rostralis. A patch of white postfemoral warts. Iris dark brown with many tiny brassy flecks. Coloration at night: pattern similar; ground color of dorsum light tan or buff; markings light gray-brown; subocular spot yellowish-white. Usual coloration in captivity: dorsum light yellowish, olive, or citron; pattern indistinct; subocular spot light green of greenish-white. Occasional coloration: dorsum bright leaf-green; pattern dark green; subocular spot bright canary yellow, sulfur yellow, or vivid grass green; hind foot pale lavender, in striking contrast with remainder of animal. The mottling of the concealed surfaces varies in intensity, but the greenish-white of the interstitial areas does not alter.

DESCRIPTION OF PARATYPES. The snout-vent length varies from 34.4 to 37.7 mm. There are no conspicuous differences from the type. Measurements are included in the following discussion.

DISCUSSION. In 1928 Viosca described the "bird-voiced tree-frog", naming it *hyla avivoca* (Viosca, 1928: 89). However, some workers thought that this might be the frog which Cope had described under the name of *H. versicolor phaeocrypta* (Cope, 1889: 375). In 1945 Mittelman undertook to settle this controversy by means of biometric analysis (Mittleman, 1945: 31). He found that *avivoca* and *phaeocrypta* were identical; and he also evolved certain ratios serving to separate *H. phaeocrypta* from the similar *H. v. versicolor*. His ratios were as follows: *phaeocrypta* - snout-vent/hind limb 68%, range 62.0-74.0%; interocular space/snout-vent 11.4%, range 8.0-13.3%; internasal space/snout-vent 8.5%, range 7.1-10.0%. *Versicolor* - snout-vent/hind limb 74%, range 66.0-78.0%; interocular space/snout-vent 8.9%, range 7.7-10.7%; internasal space/snout-vent 7.9%, range 6.4-8.9%. All these ratios displayed some overlap. One ratio displayed no overlap at all: tympanum/eye 43.0%, range 33.0-47.5% in *phaeocrypta;* 60%, range 50.0-71.0% in *versicolor*. I have relied upon Mittleman's figures for a definition of western *phaeocrypta;* although a few of his 91 specimens may have been from the east, most were from Mandeville, Louisiana, the type locality of *avivoca*.

In 1933 Harper called attention to the presence of the "bird-voiced *Hyla*" on the Atlantic Coastal Plain (Harper, 1933: 228). He recorded it near Louisville, Jefferson County, and Oak Park, Emanuel County,

Georgia. Recently I recorded it from Richmond County, Georgia (Neill, 1948: 108). Extensive collecting reveals that Spirit Creek, about 15 miles below the Fall Line in Richmond County, marks the inland limit of the range in Georgia. There are no published records from South Carolina, although Chamberlain suggested that the form might be found there (Chamberlain, 1939: 26). Actually the species is common in many parts of South Carolina; I have collected series at scattered points in Aiken, Barnwell, and Allendale counties. Mittleman remarks "I have had only a few specimens from peripheral points in the range of *phaeocrypta* available to me; these in no discernible way differed from other material." (*op. cit.*: 34). In the extensive series of eastern specimens available to me I find certain differences from Mittleman's ratios.

Fourteen sexually mature males were taken near Cushingville, Emanuel County, Georgia. (All specimens listed herein as *phaeocrypta* are unquestionably referable to that form, or at least to the "bird-voiced *Hyla*", not *versicolor*. All were vocalizing when caught; all displayed consistent color differences from the common tree-toad. Measurements were made in the fashion outlined by Mittleman.) These specimens gave the following figures (range of variation in parentheses): snout-vent 35.5 mm (32.4-38.0 mm.); snout-vent/hind limb 69.9% (68.0-72.9%); interocular space/snout-vent 10.3% (9.2-10.9%); internasal space/snout-vent 8.9% (8.0-9.9%); tympanum/eye 51.4% (47.9-59.5%). The series averages a bit larger than Mittleman's. The first three ratios are well within the proper limits, although the first two deviate somewhat from the *phaeocrypta* average and toward that of *versicolor*. The ratio tympanum/eye is completely outside the range of western *phaeocrypta* (although yet a low figure as contrasted with most *versicolor*).

Ten specimens from 10 miles west of Allendale, Allendale County, South Carolina, gave the following figures (all sexually mature males displaying characteristic color and voice differences from *versicolor*): snout-vent 35.8 mm. (32.7-38.5 mm.); snout-vent/hind limb 68.1% (64.9-70.8%); interocular space/snout-vent 10.4% (9.1-11.5%); internasal space/snout-vent 8.2% (6.1-9.4%); tympanum/eye 49.9% (43.2-56.7%). The first three ratios are within theoretical *phaeocrypta* limits, but are slightly inclined toward *versicolor*. The tympanum/eye ratio is higher than the *phaeocrypta* and lower than the *versicolor* expectancy; the range of variation overlaps both forms.

Eight sexually mature males, of characteristic color and voice, from Little Hell Landing, near Millett, Allendale County, South Carolina, gave the following figures: snout-vent 34.7 mm. (32.7-35.6 mm.); snout-vent/hind limb 69.6% (66.1-72.6%); interocular space/snout-vent 10.6% (9.5-12.0%); internasal space/snout-vent 7.7% (7.1-8.5%); tympanum/eye 49.5% (43.9-55.9%). Again the first three average ratios are slightly inclined toward *versicolor*, although within *phaeocrypta* range. The ratio tympanum/eye is again intermediate.

Two specimens from 7 miles north of Canoochee, Emanuel County, Georgia, although breeding, had not yet reached the usual adult size: snout-vent 32.1 mm. (32.0-32.3 mm.); snout-vent/hind limb 63.3% (61.8-64.8%); interocular space/snout-vent 9.4% (9.3-9.5%); internasal space/snout-vent 9.6% (9.4-9.8%); tympanum/eye 52.3% (in both specimens).

Twenty specimens are at hand from Midville, Burke County, Georgia, all males of characteristic color and voice, including the 8 paratypes and 12 topotypes: snout-vent 35.6 mm. (33.5-37.7 mm.); snout-vent/hind

limb 69.2% (64.4-74.4%); interocular space/snout-vent 11.0% (10.4-11.8%); internasal space/snout-vent 9.3% (8.1-10.2%); tympanum/eye 55.9% (46.6-62.7%).

The combined averages for all the above specimens, 54 sexually mature males, are as follows: snout-vent 35.3 mm. (32.0-38.5 mm.); snout-vent/hind limb 69.0% (61.8-74.4%); interocular space/snout-vent 10.5% (9.1-12.0%); internasal space/snout-vent 8.7% (7.1-11.8%); tympanum/eye 52.5% (43.2-62.7%). The last ratio is clearly a diagnostic feature of *ogechiensis*.

The literature is hazy concerning females of *phaeocrypta*. Viosca says of "*avivoca*" that the females are larger than the males, but gives no measurements of the former. Carr remarks that he has never seen a female (Carr, 1940: 58). Mittleman notes that he has seen but three females; he gives no measurements of these, but states that the maximum size of females is 43 mm. Harper identified a female tree-frog from Jefferson County, Georgia, as "*avivoca*", and recorded a snout-vent length of 49 mm. Mittleman decided that this probably was a *versicolor*, but commented, "if Harper's specimen is truly referable to *phaeocrypta* it probably indicates a significant size trend in Atlantic coastal populations" (op. cit.: 34). Actually, females of *phaeocrypta* from Georgia and South Carolina reach an even greater length than Harper's specimen. I have collected three females of *H. p. ogechiensis*. One such, from 11 miles east of Sylvania, Screven County, Georgia, gave the following measurements: snout-vent 52.1, hind limb 79.3, interocular space 6.1, internasal space 4.6, tympanum 3.8, eye 6.5 mm. A female *ogechiensis* from Wadley, Jefferson County, Georgia, gave the following data: snout-vent 52.5, hind limb 77.8, interocular space 5.0, internasal space 4.0, tympanum 4.0, eye 6.0 mm. The third specimen is not available; I find in my notes the comment: "snout-vent length fully 2 inches". All these specimens displayed the diagnostic coloration of *ogechiensis*, and one example was in amplexus with a typical *ogechiensis* male. These large tree-frogs are unquestionably the females of *p. ogechiensis*, and differ in many obvious respects from females of *versicolor*. (Adult female *versicolor* from Georgia and South Carolina are differently proportioned; more warty; ground color usually a lichen-gray or silver-gray, colors not noted in either sex of *ogechiensis;* axilla, groin, and postfemoral surfaces with a wash of rich orange areolated with black, the orange involving the entire under surface of the femur and the posterior third of the belly.)

The most characteristic color feature of *ogechiensis* (Both sexes) is the pale greenish white of the axilla, groin, and concealed surfaces of the legs. This color is not affected by metachrosis, Individually it varies from egg-shell white to white tinged with greenish or yellowish. The color does not extend upon the under surface of the femur or upon the belly. The longitudinal extent of this color, often from elbow to tip of toes, may be diagnostic of *ogechiensis*. In *p. phaeocrypta* the concealed surfaces are green or yellow-green; in southeastern *versicolor* orange or orange-yellow.

I have collected *H. p. ogechiensis* at the following localities: SOUTH CAROLINA. *Aiken Co.:* Beech Island, Kathwood, Hawthorne; *Barnwell Co.:* Barnwell, 2 miles west of Dunbarton; *Allendale Co.:* 10 miles west of Allendale; Little Hell Landing near Millett. GEORGIA. *Richmond Co.:* DeBruce, Tahoma, Walkinshaw, McBean; *Burke Co.:* Midville, 4 miles north of Green's Cut, 6 miles northeast of Shell Bluff, Sardis; *Screven Co.:* 11 miles east of Sylvania; *Jenkins Co.:* Millen, Herndon, Rogers Landing; *Emanuel Co.:* Cushingville, 7 miles north of Canoochee;

Treutlen Co.: Orland; *Jefferson Co.*: Louisville, Wadley; *Washington Co.*: Oconee.

Hyla phaeocrypta ogechiensis is confined to river and creek swamps of the Atlantic Coastal Plain drainage; *H. p. phaeocrypta* occupies a similar habitat in the Gulf Coastal Plain drainage. Almost certainly the barrier between the two is the Georgia Divide, which separates the Atlantic and Gulf coastal watersheds. *H. p. ogechiensis* is lacking from the Piedmont, and likewise from the true "flatwoods" or lower Atlantic Coastal Plain of Georgia and South Carolina. A paper is in preparation on the life history of this little-known frog.

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Department of Biology, Augusta Junior College, Augusta, Georgia

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LISTS OF RECENT HERPETOLOGICAL LITERATURE

Mr. Walter L. Necker, 1338 Diversey Parkway, Chicago 14, Ill. has published his first quarterly "Herpetological Literature". In view of this excellent service we discontinue our lists. Please send copies of your papers to Mr. Necker who will gladly send you his list in return.

* * *

Dr. James A. Slater has been elected a Fellow of the Herpetologists League.

* * *

Persons who were subscribers before the organization of the Herpetologists League and later rejoin may be considered Charter Members.

* * *

The Natural History Society of Maryland; has changed the name of its quarterly journal from: "Maryland, A Journal of Natural History" to "Maryland Naturalist", 2101 Bolton St., Baltimore 17, Md.

PROPOSED REPRINTING OF BOULENGER'S BRITISH MUSEUM HERPETOLOGICAL CATALOGUES

In 1937 the British Museum (Natural History) reissued the eight volumes of Gunther's "Catalogue of Fishes" (1859-1870) in a photographic facsimile, which, except for the slightly thinner paper, is an exact duplicate of the original work. Second-hand sets of this most important of all ichthyological treatises had been bringing up to $200., and availability of the reprint, at the low price of approximately $15. (at the present exchange rate), has been a great and continuing boon to ichthyologists.

Boulenger's British Museum catalogues of reptiles and batrachians occupy an even more important place in herpetology than Gunther's Catalogue does in ichthyology, especially since they are beautifully illustrated. They also have long been out of print and now bring very high prices when upon rare occasions single copies are offered by second-hand dealers. Younger herpetologists and institutions needing these complete monographs of the living species of reptiles and amphibians of the world have frequently despaired of obtaining them at any price.

A recent suggestion by the undersigned that the British Museum issue facsimile editions of the Boulenger catalogues brought an interested response from Mr. H. W. Parker, Keeper of Zoology. He points out that concrete evidence that there would be no financial loss would have to be presented before the project could be considered, and suggests some sort of canvass of American herpetologists who might be interested in purchasing copies.

Cost has not been discussed, but prospective purchasers would naturally have to have some notion of the probable prices of the different volumes. The prices for the 1937 facsimile volumes of the fish catalogue are almost exactly the same as the original prices of the first edition. While it is to be hoped that a somewhat comparable price ratio could be maintained for the herpetological catalogues, it should be realized that printing costs in Britain have risen sharply since 1937. The original prices, at the present exchange rate, were as follows: *Batrachia Salientia* (1 vol., 503 pp., 30 pls., $6.06), *Batrachia Gradientia* (1 vol., 127 pp., 9 pls., $1.82), *Chelonians and Crocodiles* (1 vol., 311 pp., 6 pls., $3.03), *Lizards* (vol. 1, 436 pp., 32 pls., $4.04; vol. 2, 497 pp., 24 pls., $4.04; vol. 3, 575 pp., 40 pls., $5.24), *Snakes* (vol. 1, 448 pp., 28 pls., $4.25; vol. 2, 382 pp., 20 pls., $3.55; vol. 3, 727 pp., 25 pls., $5.24). The total for all nine was *$37.27*, a price for which the Batrachia Salientia alone could not be obtained today.

Individuals and institutions interested in purchasing one or more of these nine volumes are urged to write immediately to the undersigned, *on one-cent postcards*, giving name, address, volumes in which interested, and number of copies of each - nothing more. These cards will *not* be considered to be orders for copies, but merely an expression of desire to buy if the volumes, or part of them, are reissued at a reasonable price. The cards will be forwarded to Mr. Parker for his information. It hardly need be pointed out that the response to this request may determine whether the Boulenger catalogues will ever again become generally available.

George S. Myers, Natural History Museum, Stanford, Calif.

THE MUSK TURTLES OF GEORGIA

By Wilfred T. Neill

Two species of *Sternotherus* have been recorded from Georgia, *S. minor* in the Coastal Plain and *S. odoratus* throughout the state. Early records of *S. carinatus* are in error. Recently I listed *S. peltifer* from Georgia (1948; Herpetologica 4: 114). The reason for this action appears herein. However, the situation is still confused, for there are at least four different forms of *Sternotherus* in the state. Perhaps this local list will point the way to broader investigations.

A form of musk turtle, found in the Fall Line region of eastern Georgia and western South Carolina, is characterized by a long, high shell, a prominent vertebral keel, no lateral keel, loose imbrication of the dorsal scutes as compared with *S. odoratus*, a head slightly smaller than that of *minor*, and numerous stripes on the head and neck. These and other features suggest *peltifer*. However, the gular shield is small, broader than long, but not divided. I have several times found this form in the larger lakes of Richmond County, Georgia.

Mr. Francis L. Rose, enthusiastic naturalist of Augusta, has presented me with two living examples of this type, taken in a muddy oxbow of the Savannah River on the South Carolina side about 8 miles above Augusta, Georgia. The following description of one of these specimens, which is typical, may be compared with the account of *S. peltifer* Smith and Glass (1947; Journ. Wash. Acad. Sci. 37, no. 1: 22).

Female. Carapace a smooth elongate oval when viewed from above, width about .69 of length, depth about .36 of length; rear edge of carapace not flared, barely notched medially. Anterior lobe of plastron wider and slightly shorter than posterior lobe (along median line), bridge about .26 of plastron length. Head moderately large; upper jaw feebly and lower jaw rather strongly hooked; numerous longitudinal rows of fine papillae on neck; two chin barbels with a small papilla between them; some of the gular papillae enlarged but none comparable in size to the mental barbels. Dorsal scutes loosely imbricate as compared with *odoratus;* first vertebral long, triangular, apex truncate, greatest width about .73 of greatest length; second, third and fourth vertebrals pentagonal, each a little wider than long; fifth vertebral pentagonal, slightly longer than broad; nuchal very small; marginals 11 on each side, the posterior 2 on each side more elevated than the others, the posterior 6 on each side at least half as high as long, the anterior 5 mostly slightly less than half as high as long, none serrate although the posterior edge of each of the four rear scutes on either side slightly overhanging anterior edge of succeeding scute. Gular shield small, single, distinctly broader than long. Axillaries a little more than three times as long as wide; inguinals about 3 times as long as wide. Dorsal scutes dark olive-brown, their free margins outlined with black, the underlying sutures showing through the translucent scutes as light lines. Head and neck olive-brown; a black-bordered yellow stripe extending from the upper margin of the orbit to a point above the angle of the jaws, bending thence inward toward the midline and ther extending posteriorly on the upper surface of the neck, becoming brownish-yellow; a yellow line, somewhat broken, beginning just above the angle of the jaws and extending on to the neck, where it becomes brownish-yellow and indistinct; between these two lines another yellowish one present only on the neck but extending anteriorly almost to the

'bend' of the uppermost head stripe; many other indistinct lines of brownish-yellow on upper and lower surfaces of neck. Throat, tip of snout, and posterolateral portion of head with yellow spots; limbs with black flecks in vaguely lineate arrangement; tail indistinctly lined with dark and light. Carapace length 96.6 mm. (straight line); plastron length 68.5 mm. (median line.)

The similarity to *peltifer* is evident, although certain characters do not conform to those of the type. Whether such turtles are really *peltifer*, or perhaps *peltifer-minor* intergrades, is uncertain. They might be allocated with *peltifer* for the time being, since they resemble that form more than they do any other described species.

This form of *Sternotherus* has been collected at several localities in the Fall Line area of eastern Georgia and adjacent South Carolina. The odor given off by this turtle is relatively faint and not particularly unpleasant, differing from the powerful musky stench of *odoratus* or from the moderately strong, somewhat pungent aroma of *minor*.

Turtles resembling the 'loggerhead musk turtle' of Florida, and agreeing with Pope's figure of *minor* (1939; Turtles of the U. S. and Canada: figs. 8, 9), are found near Midville, Burke County, Georgia, about 45 miles below the Fall Line. In specimens from this locality, the head is spotted, the neck dark lined in young examples, mottled or unicolor in old. The shell is rugose, and triply keeled except in the largest adults, in which the lateral keels are obscure. These turtles reach a large size for a *Sternotherus*, the straight line measurement of some carapaces being 5 inches or more. In old adults the head is enlarged, the upper jaw broadened. Recently, Mr. E. Ross Allen, of Silver Springs, Florida, sent me several turtles which he had selected as typical Florida *minor*. They agree quite well with the Georgia specimens. Midville represents the approximate inland limit of the range in Georgia.

The situation is complicated by the fact that the southern form or representative of *S. odoratus* is widely different from the northern one, and has been called *minor* by some workers. The vertebral keel usually remains prominent throughout life; the head is often gray-brown or olive-brown, infrequently blackish; the lower head stripe begins just above the angle of the jaws, or extends anteriorly from that point only as a series of dashes or spots; the upper head stripe may also be broken or absent on the snout; both head stripes may be reduced to a series of spots; the first vertebral is very long and narrow. This type of turtle ranges from about the Fall Line southward into Florida. Mr. Allen supplied me with a series of turtles that he considered to be typical Florida *odoratus;* they proved to be of this type. The Florida specimens and the Georgia Coastal Plain specimens are closely similar, but none agrees with *odoratus* from above the Fall Line.

Ditmars diagnosed *'minor'* as having 2 yellow lines on the side of the head, the lower beginning above the angle of the jaws (1936; Reptiles of North America: 393). Obviously he also had true *minor*, apparently considering such turtles to be old adults of the form with the striped head. His accompanying photograph of *'minor'* (Pl. 115, lower) resembles southern *odoratus* and does not seem to be *minor*. Beneath the photograph is the statement, 'Closely allied to the form shown above *(odoratus)*'. Haltom likewise apparently had 'southern *odoratus*' and called it *Kinosternon carinatum* (1931; Ala. Mus. Nat. Hist. Pap. 11: 122). He defines the range as 'western Georgia to Louisiana'. His description, like Ditmars', is evidently composite.

The question arises as to whether *minor*, as currently defined, might display a striped head when young. This is definitely not the case. Small specimens may have dark lines on the neck, but the head is dark spotted and without yellow lines from the time of hatching.

The type locality of *S. minor* is 'Mobile, Ala., Columbus, Ga., and New Orleans, La.', according to the Checklist. Pope states that the New Orleans specimens are the result of introduction (op. Cit.: 48); certainly the locality is out of the range of the 'loggerhead musk turtle'. In my opinion, Columbus is also out of the range of the form. In eastern Georgia the range of *minor* extends inland to about 45 miles of the Fall Line. If the form ranges farther inland in western than in eastern Georgia, the circumstance would be completely at variance with the rules of reptile distribution in the state. Probably *minor* does occur in southeastern Alabama, but I believe that most statements to this effect are based on the supposed Mobile record. Haltom's records are unreliable since they are probably based on 'southern *odoratus*'; and his remarks on the habits, abundance, and 'very decided odor' of *'K. carinatum'* do not suggest the 'loggerhead musk turtle'.

The form that I have called 'southern *odoratus*' does occur at Columbus and Mobile, and probably at New Orleans. It may be very significant that earlier workers associated the name *minor* with this form. The types, if extant, should certainly be re-examined to determine what they really are. It is hard to see how anyone, describing the 'loggerhead musk turtle' on the basis of several specimens, would select the name *'minor'* for it, when it is one of the largest and most impressive of kinosternids. The name would be most appropriate for the rather diminutive 'southern *odoratus*', however.

Apart from their different ranges, the *peltifer*-like turtles and the 'southern *odoratus*' may be distinguished by the fact that in the latter the head is somewhat darker, the head stripes or spots are very distinct, the uppermost head stripes extend straight back on to the neck with no stripes between them, the shell is less sharply keeled in the adult, the scutes of the carapace are not imbricate, and the carapace is blackish. In the former the head is lighter, the head stripes are less distinct, the uppermost head stripes bend inward on the temples and extend posteriorly on the upper surface of the neck, the neck bears a vertebral and many lateral and gular stripes, the shell is sharply keeled in the adult, the scutes of the carapace are imbricate, and the carapace is a brown or light horn color.

In the Piedmont of Georgia, and extending southward about to the Fall Line, is a small musk turtle with a gray-brown or blackish head bearing two bright yellow stripes that begin at the snout and extend on to the neck. The first vertebral is broad; the vertebral keel is usually lost in the adult, the carapace often becoming flattened. This form I consider to be true *odoratus*. Below the Fall Line it is replaced by the 'southern *odoratus*' described above.

Thus there would appear to be four forms of *Sternotherus* in Georgia: a large, prominently keeled type, resembling *peltifer*, in the lower Piedmont and upper Coastal Plain; the 'loggerhead musk turtle', currently called *minor*, in the middle and lower Coastal Plain; typical *odoratus* above the Fall Line; and a form like *odoratus* but with reduced head stripes, narrower first vertebral, and more prominently keeled shell, below the Fall Line. I believe that the last mentioned form, the *'minor'* of earlier authors, is at least subspecifically distinct from northern *odoratus*, which is, however, its nearest relative.

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A LARGE LITTER OF *NATRIX* IN FLORIDA

By Sam R. Telford

On July 15, 1948, a four foot two inch *Natrix cyclopion floridana*, in my collection, gave birth to 101 young. Only 41 of these were alive at birth, but the others were perfectly formed. There were no unfertile ova. Ten specimens were selected to be measured; the young snakes measured between 253 and 275 mm., with an average of 261 mm.

The female was captured April 11, 1948, about 20 miles SW of Lake Okeechobee, in Hendry Co., Fla. At the time of capture, the snake weighed six pounds. While in captivity, she refused all food and vigorously resented any handling.

Another specimen captured in April, 1946, was five feet six inches in length and weighed nine pounds. This specimen contained 67 well-formed embryos.

Schmidt and Davis (1941, p. 217) mention two broods of *N. c. floridana*, numbering 10 and 14. This appears to be the only record of the species' breeding habits.

Winter Haven, Fla.

* * *

HATCHING SNAKE EGGS

Mr. C. B. Perkins of the San Diego, California Zoo uses the following method very successfully in hatching snake eggs. Use a crock about 6 inches in diameter and about 4 inches high. Moisten a paper towel, express as much water as possible by hand; fold and place in bottom of crock. Fold a dry paper towel and lay it over the first. Place eggs on top. Cover crock with a piece of glass. Add a few drops of water if necessary to bottom paper if eggs seem too dry.

* * *

THE BRITISH HERPETOLOGICAL SOCIETY

The Society was founded in 1947; its first annual journal appeared in June, 1948 and is devoted to one 38 page article by R. H. R. Taylor; the distribution of reptiles and amphibia in the British Isles, with notes on species recently introduced. The journal is 4/, subscribing membership 10/. Secretary, Mr. Alfred Leutscher, British Museum, Cromwell Road, London, S. W. 7, England.

MATING BEHAVIOR AND SEASONAL CLOACAL DISCHARGE OF A FEMALE *THAMNOPHIS SIRTALIS PARIETALIS*.*

By D. F. Munro

D. F. MUNRO

It is generally stated that the female snake plays a completely passive role in mating, and the impression is thereby created that from the organic and behavioristic standpoints only the male is an active participant in the process. Consequently, the following account, based on observation of a captive female, will perhaps be of interest as suggesting that a modification of the general statement may be necessary.

A female *Thamnophis sirtalis parietalis* was caught in May, 1945, in northwestern Arkansas. She was then about 28 inches in length, with approximately a third of the tail missing. The snake was remarkably amiable from the moment of capture: she did not struggle, bite, or pour out scent when seized, though she was clearly on the alert. She adjusted immediately to captivity, and only on rare occasions (particularly such as those here discussed, and before snake-birth) has she become restless, making continuous efforts to work her way out of the cage.

This snake had mated in the wild. Unfortunately, she had to be moved and disturbed repeatedly as the critical time approached, and the birth of the young was adversely affected. The first individual was born alive about the middle of August, 1945, but the next two or three (over the course of a week) were dead, as were also the members of the final group of about twenty. The live one died after a couple of weeks. Army life did not agree with little snakes.

During the winter of 1947-48, as also in previous years, the snake was kept in a cage on a study table at room temperature (ordinarily about 70° by day, 50°-60° by night), and remained moderately active. If in concealment after being left undisturbed all day, she almost invariably came to the front of the cage in the evening to bask in the electric light, sometimes retiring again after an hour or so. There was no evidence of hibernation--the snake was seen on the move practically every day.

In March, 1948, there appeared to be a correlation between increases in the snake's activity and the occurrence of periods of mild weather, even though the room temperature was regulated as before. On March 23 the female definitely became restless and nervous, and during the next few days persistently crawled about the cage, trying to get out. She appeared to be very sensitive to touch or pressure on the region of the base of the tail. If, in crawling around in the cage, she brushed this part of her body against any object or against herself, she would arch her tail as if to void excrement, then turn the anal section of her body on its side. She did the same thing when experimentally touched about the anal region with a piece of wood, also when picked up and touched in that region (below, on the side, and above) with the finger, and likewise when the end of her tail was slightly lifted by hand. Contrary to custom, she did not turn her head back swiftly with

* Read at the meeting of the Pacific Division of the A.A.A.S. at the U. of Cal., June 22, 1948.

half-opened mouth, as if to catch something (her usual reaction when so touched).

On March 26 a white substance, thinner than ordinary milk of magnesia, began to ooze from the anal opening; this substance did not have a fecal or even a disagreeable odor. With this matter, which dried to a chalky consistency, the snake made tracks on the shellacked wooden floor of the cage as she moved about, and a small quantity, rather watery, would seep out to form a tiny puddle under the vent if she lay still for some time. The cage was cleaned frequently during this period.

When given the run of a grassy area out of doors at this time, the snake behaved in a way quite at variance from her habitual leisurely prowling around. Now she darted this way and that, occasionally pausing to arch her tail slightly, pried into clumps of weeds, raised her head high to look about, and in general gave the appearance of being uneasy, but not timid. To judge from her actions, she was looking for something. She had been fed a medium-sized frog on February 28, some horsemeat on March 18 (part of which was vomited as a nearly colorless mass on March 21 or 22), and some earthworms on March 28. She may have been hungry; on the other hand, it seemed reasonable to conjecture that possibly she wanted to mate.

A smallish local male *Th. s. p.* was caught on March 28 and put in the cage with the female. At first it looked as if there would be a mating, for, though just captured, the male almost immediately approached the female in the customary manner, sliding his chin along her back and wriggling against and over her, with some body-twitching. But despite his advances, there was no union: the female seemed to ignore the male, and crawled about slowly. He desisted after two or three minutes and went over to a corner of the cage, remaining quiet but alert. A few moments later the female became more active, prowling around the cage, crawling and looping over the male, and apparently ready to mate, to judge from the fact that she several times arched her tail. But the male now seemed to be reacting unfavorably to his capture and showed considerable timidity. He was put in another cage by himself. A few hours later he was fed a small frog.

On the following day, March 29, another male was caught and put with the female, and the series of events just described was repeated almost in detail, also without a mating. This second male was removed and the first male then was placed in the female's cage again. The male ran his chin along the back of the female and they mated at once. It was seen that the female had facilitated the union by arching her tail.

As soon as they were coupled, the female began to crawl around in the cage as if oblivious of the male attached to her. She was at least three times as bulky as he, and consequently she pulled him about easily. Only at intervals were their bodies parallel and together, partly, it seemed, by chance, and partly as a result of rather subdued efforts by the male. Most of the time she was dragging him backwards. This crawling on the part of the female lasted a full ten minutes, although there were brief intervals of quiet, especially toward the end of that time, when both snakes developed the body-twitchings that occur at mating. Then suddenly they parted.

Almost from the moment of completion of the mating a striking change came over the behavior of the female snake. Whereas for the past several days she had been restless and seemingly very sensitive in the anal region, she now became almost sluggish, apparently content to lie in a loop without moving. She was rather unresponsive to

experimental touch—there was no more arching of the tail. The white discharge, which had been fairly fluid, was thick and pasty for the next two or three days, seeming to clog the anal opening, though it still made tracks on the cage floor as the snake shifted about from time to time. By April 3, however, it had ceased to appear, and the snake was a little more active again, much as she had been prior to the oncome of the discharge.

Young were produced in the latter part of July 1948.

In the spring of 1946, the year following her capture, the female snake had developed, though not so markedly, the same symptoms and showed the same behavior as those described above. One or two males were put into the cage with her at this time, but no mating was seen to take place, although the males endeavored to effect union. The female did not arch her tail in the presence of the males. They were left with her occasionally, unobserved, for long periods, during which time, of course, mating could have occurred. However, no young were produced in 1946.

The spring of 1947 brought a repetition of the phenomena of the preceding year. But this time, some five or six days after the advent of the discharge, there was a mating on April 1, in which the female was not merely passive. The union was achieved upon the first introduction of the male into the cage, as quickly and in the same manner as was the case this year. On July 26, 1947, the female produced 16 live young, 3 dead (one malformed), and 4 eggs.

If generalizations may be made on the basis of the behavior of one captive female snake, it is evident that at least for the Garter Snakes the view is erroneous that the role of the female is one of complete passivity in the act of mating; it appears also that the female may even be definitely active in the sexes' finding each other for mating purposes in the spring.

Consideration of the significance of the white anal discharge in the snake here discussed centers on the fact that it manifests itself only during the latter part of March; it is thus a strictly seasonal phenomenon, appearing and disappearing abruptly. Furthermore, there is a progressive change in the consistency of the secretion during the period, possibly related to the accomplishment of mating.

The suggestion has been made that the snake may be afflicted with an intestinal parasite responsible for the discharge. That the snake is inclined to vomit if fed too much or too often might also be indicative of such infestation. But the brief duration of the white discharge and its invariable association with both the breeding season and the snake's behavior seem to warrant doubt as to the plausibility of this explanation. Moreover, the health of this snake is otherwise excellent, so far as can be inferred from her behavior: she feeds well, excretes normally, and casts her skin regularly and easily.

It has also been suggested that the discharge is a nephridial one, perhaps due to captive living conditions involving the lapse of hibernation. During the winters of 1945-46 and 46-47 the snake was fed small quantities at irregular intervals, and defecated accordingly. But from October 9, 1947, to February 28, 1948, she was fed nothing, and of course there was practically no elimination beyond the end of October. Periodic excretion was resumed after the start of feeding in the spring, and was apparently normal in all respects. The fact that the snake had been fed during two of the winters and not at all during the third seems to prove that the discharge can not be attributed to

factors of diet or digestion, since it occurred each year at the time customary for this individual.

Beginning in April, 1946, a local female *Th. s. p.*, about 30 inches long (hence obviously mature), was caged with the snake in question for about a year, and from September, 1946, a second somewhat smaller female was kept with both of them a large part of the time until the following summer. Both these females were nervous and shy in captivity. Neither of them showed any evidence of having developed a cloacal discharge, neither displayed seasonal behavior comparable to that of the other female, and neither was seen to mate, although aggressive males were caged with them from time to time at the mating season. From the failure of these two females to show any discharge, the conclusion can be drawn that if the discharge is symptomatic of a disease of female Garter Snakes, it is not highly contagious. On the other hand, if the discharge is essentially a normal condition, other females, if fertile and ready to mate, might be expected to show it, though perhaps not to so pronounced a degree. The fact that the two more recent captives did not develop the discharge and also refused to mate when approached by eager males could be interpreted as supporting the view that a normal glandular function is involved in the occurrence of the secretion in the first snake, a function presumably inhibited in the other two by their nervousness under the conditions of captivity.

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A CURE FOR "MOUTHROT"

By Dean Linscott

A five-foot specimen of *Constrictor constrictor constrictor* when acquired, was so badly infected with mouthrot that it could not close its mouth because of the accumulated slough. ("Mouthrot" is used here to designate the disease which invades the bones and tissues of snakes' mouths, usually killing infected specimens within a relatively short time.)

Treatment was begun by scraping free all dead tissue that could be dislodged; then the throat and mouth were sprayed liberally with an aqueous solution of penicillin, which was prepared by adding water to a 20 ml, 100,000-unit ampoule of sodium crystalline penicillin G. Spraying was continued twice a day for five weeks, except for one day each week when sulfathiazole powder was sprinkled in the specimen's mouth because it seemed to aid in drying up a clear slime which formed after prolonged use of the penicillin.

Treatment was discontinued after five weeks, and two months later the specimen killed and ate a half-grown guinea pig, later accepting two more of these animals. During the six months the snake was observed, ecdysis occurred twice, the skin being cast entire both times; this would seem to indicate good health.

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